

3.0 FUTURE ASSEMBLY OF ALTERNATIVES

The next step of the Feasibility Study process will be to take the retained process options and combine them to form alternatives for the site as a whole, although this step is not performed in this Technical Memorandum. To assemble alternatives, general response actions should be combined using different technology types and different volumes of media and/or areas of the site. Often more than one general response action is applied to each medium. For example, alternatives for remediating soil contamination will depend on the type and distribution of contaminants and may include thermal desorption of soil from some portions of the site and capping of others.

Alternatives should be defined to provide sufficient quantitative information to allow differentiation among alternative with respect to effectiveness, implementability, and cost. Parameters that often require additional refinement include the extent or volume of contaminated material and the size of process options selected.

After the alternatives have been refined with respect to volumes or media, the technology process options need to be defined fully with respect to their effectiveness, implementability, and cost such that differences among alternatives can be identified. The following information should be developed, as appropriate, for the various technology processes used in an alternative:

- Size and configuration of treatment systems or containment structures. For media contaminated with several hazardous substances, it may be necessary to run pilot tests to first determine which contaminants impose the greatest treatment requirements prior to sizing or configuring accordingly.
- Time frame in which treatment, containment, or removal goals can be achieved. The remediation time frame is often interdependent on the size or configuration of a treatment system. The time frame may be influenced by technological limitations (such as maximum size consideration, performance capabilities, and/or availability of adequate treatment systems or disposal capacity).

- Rates or flows of treatment. These will also influence the sizing of technologies and time frame within which remediation can be achieved.
- Spatial requirements for constructing treatment or containment technologies or for staging construction materials or excavated soil or waste.
- Distances for disposal technologies. These include approximate transport distances to an acceptable off-site treatment and disposal facilities and distances for water pipelines for discharge to a receiving stream or a POTW.
- Required permits for off-site actions and imposed limitations – These include National Pollutant Discharge Elimination System (NPDES), pretreatment, and emission control requirements, coordination with local agencies and the public, and other legal considerations. These may also encompass some action-, location-, and chemical-specific ARARs.
- Adjustment of technology design based on the limitations imposed by ARARs.

TABLES

TABLE 2-1A
POTENTIAL CHEMICAL-SPECIFIC ARARs AND TBCs
DRAFT TECHNICAL MEMORANDUM
REMEDIAL ALTERNATIVES SCREENING
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STRATFORD, CONNECTICUT

AUTHORITY	REQUIREMENT	STATUS⁽¹⁾	REQUIREMENT SYNOPSIS	CONSIDERATION
Federal Regulatory Requirements	NESHAPS (40 CFR 61 Subpart M (61.45, 61.150, 61.151, 61.154))	To be determined	This regulation defines asbestos.	Asbestos wastes will be handled as detailed as detailed in this regulation.
State Regulatory Requirements	Connecticut Cleanup Standard Regulations (22a-133 CGS)	Applicable	The regulations define minimum hazardous waste site remediation standards, specify numeric criteria for cleanup of soils and groundwater, and specify a process for establishing alternative, site-specific cleanup standards.	The regulations will be adhered to when determining soil cleanup standards under the capping scenario.
	Disposition of PCBs (22a-467 CGS)	Applicable	This section requires that PCBs be disposed under a permit issued by the Commissioner or with written approval of the Commissioner in a manner not inconsistent with the federal Toxic Substances Control Act (40 CFR 761).	The disposal of PCB contaminated soil will comply with the substantive provisions of this section.
	Connecticut Coastal Management Act (22a – 90 to 112)	To Be Determined	This statute establishes Connecticut's enforceable coastal zone policies in accordance with the federal Coastal Zone Management Act.	Activities performed in coastal areas would conform to these requirements.
Criteria, Advisories, and Guidance	TSCA PCB Spill Clean-up Policy (40 CFR 761.120-135)	To Be Determined	This policy applies to recent PCB spills and establishes clean-up levels for PCB spills of 50 ppm or greater at 10 ppm for non-restricted access areas and 25 ppm for restricted access areas.	Standards may be used as guidelines for soil cleanup if PCB contamination must be addressed.
	EPA Risk Reference Doses (RfDs)	To Be Determined	RfDs are dose levels developed by EPA for use in estimating the non-carcinogenic effects of exposure to toxic substances.	EPA RfDs were used to assess health risks due to exposure to noncarcinogenic contaminants present at the site. RfDs will be used in development of Preliminary Remediation Goals for facility soils.

TABLE 2-1A (cont.)
POTENTIAL CHEMICAL-SPECIFIC ARARs AND TBCs
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AUTHORITY	REQUIREMENT	STATUS ⁽¹⁾	REQUIREMENT SYNOPSIS	CONSIDERATION
	Proposal for the Connecticut Cleanup Standard Regulations (22a-133K CGS)	To Be Determined	The proposed regulations would define minimum hazardous waste site remediation standards, specify numeric criteria for cleanup of soils and groundwater, and specify a process for establishing alternative, site-specific cleanup standards.	The proposed regulations will be considered in determining soil cleanup standards.
Criteria, Advisories, and Guidance	EPA Carcinogen Assessment Group Potency Factors	To Be Determined	EPA Carcinogenic Potency Factors (CPFs) are used to compute the individual incremental cancer risk resulting from exposure to carcinogens.	CPFs were used to assess health risks due to exposure to carcinogens present at the site. These factors will also be used in development of PRGs for site soils.
	Guidance on Remedial Actions at Superfund Sites with PCB Contamination (EPA/540/G-90/007, August 1990)	To Be Determined	Describes various scenarios and considerations pertinent to determining the appropriate level of PCBs that can be left in each contaminated media to achieve protection of human health and the environment.	This guidance will be considered in determining the appropriate level of PCBs that may be left in the soil.

Notes:

- (1) Determination of the status of the requirement (i.e., applicable, relevant and appropriate, or to be considered) will be made for the individual alternatives and will be indicated on the alternative-specific ARARs tables in Section 4.0.

TABLE 2-1B
POTENTIAL ACTION-SPECIFIC ARARs AND TBCs
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AUTHORITY	REQUIREMENT	STATUS⁽¹⁾	REQUIREMENT SYNOPSIS	CONSIDERATION⁽²⁾
Federal Regulatory Requirements	RCRA - General Facility Standards (40 CFR 264.10 – 264.18)	To Be Determined	General facility requirements outline general waste analysis, security measures, inspections, and training requirements.	Any on-site treatment, storage, or disposal facility will be constructed, fenced, posted and operated in accordance with the substantive provisions of this requirement.
	RCRA – Preparedness and Prevention (40 CFR 264.30 – 264.37)	To Be Determined	Outlines requirements for safety equipment and spill control.	Safety and communication equipment will be maintained at the site and local authorities will be familiarized with the site operations, in accordance with the substantive provisions of these requirements.
	RCRA - Contingency Plan and Emergency Procedures (40 CFR 264.50 – 264.56)	To Be Determined	Outlines requirements for emergency procedures to be used following explosions, fires, etc.	Contingency plans will be developed and response activities will be implemented in accordance with the substantive provisions of these requirements.
	RCRA – Groundwater Monitoring (40 CFR 264.90 – 264.93)	To Be Determined	Details requirements for groundwater monitoring and responding to releases from Solid Waste Management Units.	A groundwater monitoring program must be developed in accordance with the substantive provisions of these requirements for any alternative which involves an on-site surface impoundment, landfill, or land treatment facility.
	RCRA – Closure and Post-Closure (40 CFR 265.110 - 264.120)	To Be Determined	Details requirements for closure and post-closure of hazardous waste facilities.	Any containment remedy will be designed to meet the substantive provisions of this requirement.
	RCRA - Land Treatment (40 CFR 264.271 – 264.282)	To Be Determined	These regulations detail the requirements for conducting land treatment of RCRA hazardous waste.	Alternatives that involve on-site land treatment of contaminated soil must comply with the substantive provisions of these regulations.

TABLE 2-1B (cont.)
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AUTHORITY	REQUIREMENT	STATUS ⁽¹⁾	REQUIREMENT SYNOPSIS	CONSIDERATION ⁽²⁾
Federal Regulatory Requirements (Continued)	RCRA – Closure of Landfill (40 CFR 264.310)	To Be Determined	This regulation details the closure and post-closure requirements for a landfill.	Alternatives that include on-site landfilling must meet the substantive closure requirements of this regulation.
	RCRA – On- site Landfills (40 CFR 264.300 – 264-309)	To Be Determined	Includes requirements for the design, construction, operation and maintenance of an RCRA Landfill	The disposal of RCRA waste in an on-site landfill must meet these requirements
	RCRA – Incineration (40 CFR 264.341 - 264.345)	To Be Determined	These regulations detail operating and monitoring requirements and impose performance standards for hazardous waste incinerators.	Alternatives that include incineration of contaminated soil must comply with the substantive provisions of these regulations. These standards may be applicable to alternatives including thermal desorption of soils or thermal oxidation of air emissions from soil treatment.
	RCRA Miscellaneous Treatment Units (40 CFR 264.601)	To Be Determined	This regulation details design and operating standards for units in which hazardous waste is treated.	Hazardous waste treatment units used for on-site treatment of contaminated media must meet the substantive provisions of these requirements.
	Land Disposal Restrictions (40 CFR 268)	To Be Determined	This regulation establishes "treatment standards" (concentration levels or methods of treatment) which wastes must meet in order to be eligible for land disposal.	Contaminated soil must be treated to attain applicable "treatment standards" prior to placement in a landfill, or other land disposal facility outside the area of contamination where placement occurs.

TABLE 2-1B (cont.)
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AUTHORITY	REQUIREMENT	STATUS ⁽¹⁾	REQUIREMENT SYNOPSIS	CONSIDERATION ⁽²⁾
Federal Regulatory Requirements (Continued)	TSCA - PCB Storage and Disposal (40 CFR 761.60, .75, .79)	To Be Determined	This regulation establishes standards for the storage, disposal, and incineration of PCBs at a concentration greater than 50 ppm.	Storage, incineration, and disposal of PCB contaminated soil must be conducted in conformance with the substantive provisions of these regulations.
	CWA National Pollutant Discharge Elimination System (NPDES) (40 CFR 122, 125)	To Be Determined	Any point-source discharge must meet NPDES requirements which include compliance with corresponding water quality standards; establishment of a discharge monitoring system; and completions of regular discharge monitoring records.	If an alternative involves treatment, and discharge of process water or groundwater collected during dewatering, discharges to surface water will need to comply with the substantive provisions of these regulations.
	CWA Pre-treatment Regulations (40 CFR 403)	To Be Determined	These regulations impose restrictions on the discharge of pollutants to Publicly Owned Treatment Works (POTW) and mandate that discharges must comply with the local pretreatment program.	If an alternative involves treatment and discharge of an aqueous waste stream from treatment process operation or dewatering, discharges to a POTW must comply with these regulations.
	RCRA - Air Emission Standards for Process Vents (40 CFR 265 Subpart AA)	To Be Determined	Standards for air emissions from process vents associated with selected processes including solvent extraction, and air or steam stripping operations that treat RCRA substances and have total concentrations of 10 ppm or greater.	Alternatives involving solvent extraction of facility soils will comply with the substantive portions of these regulations if threshold organic concentrations are met.
	RCRA, Air Emission Standards for Equipment Leaks, (40 CFR, 265, Subpart BB)	To Be Determined	Standards for air emissions for equipment that contains or contacts RCRA waste with organic concentrations of at least 10% by weight.	All remedial alternatives which include equipment for treatment of organics will comply with substantive portions of the regulation if the threshold organic concentration is met.

TABLE 2-1B (cont.)
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AUTHORITY	REQUIREMENT	STATUS ⁽¹⁾	REQUIREMENT SYNOPSIS	CONSIDERATION ⁽²⁾
Federal Regulatory Requirements (Continued)	RCRA, Air Emissions from TSDFs, (40 CFR, Part 265, Subpart CC) (Proposed 56 Fed Reg. 33490-33598, 7/22/91)	To Be Determined	Proposed standards for air emissions from treatment, storage, disposal facilities with VOC concentration equal to or greater than 500 ppm.	Proposed standards will be considered for all remedial alternatives if threshold VOC concentrations are met.
	CAA NAAQS for Particulate Matter (40 CFR 50.6)	To Be Determined	The particulate matter NAAQS specifies maximum primary and secondary 24 hour concentrations for particulate matter in the ambient air. These ambient air concentrations are not designed to apply to specific sources; rather, states may promulgate State Implementation Plan emission limits applicable to sources, which will result in attainment and maintenance of the NAAQS. Connecticut has not promulgated any particulate matter emission limits applicable to this source.	Fugitive dust emissions from site excavation and handling activities will be minimized with dust suppressants, if necessary. These measures should be sufficient to prevent any exceedances in the ambient air of the 150 µg/m ³ 24 hour primary standard for particulate matter.
	CAA NESHAPS (40 CFR 61 Subpart M (61.145, 61.150, 61.151, 61.154)	To Be Determined	These regulations specify requirements regarding removal, management, and disposal of asbestos.	Handling, treatment, and disposal of soils containing asbestos and building demolition debris containing asbestos must comply with the substantive provisions of these regulations.

TABLE 2-1B (cont.)
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AUTHORITY	REQUIREMENT	STATUS ⁽¹⁾	REQUIREMENT SYNOPSIS	CONSIDERATION ⁽²⁾
State Regulatory Requirements	Connecticut Air Pollution Regulations - Stationary Sources (Sec. 22a-174-3 RCSA)	To Be Determined	Requires that stationary sources of air pollutants meet specified standards prior to construction and operation. Prohibits operation of sources that interfere with attainment of Air Quality Standards.	For alternatives that may result in air emission (i.e., thermal treatment, solvent extraction, capping), and constitute a stationary source, the gas collection and treatment system will be designed to meet substantive standards established under these regulations.
	Connecticut Air Pollution Regulations (Sec. 22a-174-4, 22a- 174-5, and 22a-174-7 RCSA)	To Be Determined	These sections specify air emissions monitoring requirements, emissions sampling and analysis methods, and general air pollution control equipment operation requirements.	Operation and monitoring of alternatives that include emission controls systems will be conducted in accordance with the substantive requirements of these regulations.
	Connecticut Air Pollution Regulations - Fugitive Dust Emissions (RCSA 22a-174-18b)	To Be Determined	Requires that reasonable precautions be taken to prevent particulate matter from becoming airborne during demolition and construction activities and material handling operations.	Activities involving building demolition, soil excavation or handling, and cap construction must be conducted in a manner to minimize fugitive dust emissions from the Facility.
	Connecticut Air Pollution Regulations - Incineration (RCSA 22a-174-18c)	To Be Determined	Establishes regulations and emission rates for incinerators.	For alternatives that include thermal treatment, the vapor collection and treatment system will be designed to meet substantive standards established under these regulations.
	Connecticut Air Pollution Controls - Control of Odors (Sec. 22a-174-23 RCSA)	To Be Determined	This regulation prohibits emission of substances that constitute nuisances because of objectional odors. Several compounds have specific concentration limits.	Alternatives that result in the emission of regulated compounds would need to comply with the substantive requirements of the regulation.

TABLE 2-1B (cont.)
POTENTIAL ACTION-SPECIFIC ARARs AND TBCs
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AUTHORITY	REQUIREMENT	STATUS⁽¹⁾	REQUIREMENT SYNOPSIS	CONSIDERATION⁽²⁾
State Regulatory Requirements (Continued)	Connecticut Air Pollution Regulations - Hazardous Air Pollutants (RCSA 22a-174-29)	To Be Determined	Establishes testing requirements and allowable concentrations for any stack emission for the constituents listed.	Alternatives that include treatment processes that result in air emissions must include emissions control systems designed and operated to meet the substantive requirements of these regulations.
	Connecticut Hazardous Waste Site Management Regulations (Sec. 22a-449 (c) - 105, RCSA)	To Be Determined	These regulations outline requirements for the management and disposal of hazardous wastes, and the construction, location, operation, and closure of hazardous waste treatment, storage, and disposal facilities. These regulations incorporate by reference substantial portions of 40 CFR 265 (RCRA).	Alternatives would comply with those portions of the regulations that are more stringent than the corresponding federal RCRA regulations cited herein.
	Connecticut Cleanup Standard Regulations (22a-133 CGS)	To Be Determined	The regulations define minimum hazardous waste site remediation standards, specify numeric criteria for cleanup of soils and groundwater, and specify a process for establishing alternative, site specific cleanup standards.	Alternatives would comply with portions of these regulations.
	Connecticut Water Quality Standards (issued pursuant to Sec. 22a-426 CGS)	To Be Determined	Establishes designated uses for groundwater and identifies the criteria necessary to support these uses.	Alternatives would comply with water quality standards since actions are taken to minimize further degradation of groundwater.

TABLE 2-1B (cont.)
POTENTIAL ACTION-SPECIFIC ARARs AND TBCs
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AUTHORITY	REQUIREMENT	STATUS ⁽¹⁾	REQUIREMENT SYNOPSIS	CONSIDERATION ⁽²⁾
State Regulatory Requirements (Continued)	Connecticut Hazardous Waste Site Management Regulations (Sec. - 22a-449(c)-105 RCSA)	To Be Determined	These regulations outline requirements for the management and disposal of hazardous wastes, and the construction, location, operation, and closure of hazardous waste treatment, storage, and disposal facilities. These regulations incorporate by reference substantial portions of 40 CFR 264 (RCRA).	Those portions of the regulations that are more stringent than the corresponding federal RCRA regulations cited herein will be complied with.
	Connecticut Hazardous Waste Management: Land Disposal Restrictions (RCSA 22a- 449(c)(108))	To Be Determined	This section incorporates by reference the federal Land Disposal Restrictions (40 CFR 268).	RCRA waste must be treated to attain applicable standards prior to placement in a landfill outside the area of contamination.
	Connecticut Water Quality Standards (Issued Pursuant to Sec. 22a-426 CGS)	To Be Determined	Establishes designated uses for groundwater and surface water and identifies the criteria necessary to support these uses.	Remedial alternatives will be designed to minimize further degradation of groundwater and surface water. If an alternative involves discharge of an aqueous waste stream from soil treatment or dewatering, discharges to surface water will be treated to prevent degradation of surface water.
	Connecticut Discharge of Storm Water Associated with Industrial Activity (Sec. 22a-430-1 to -8, RCSA; Sec. 22a- 430b, 22a-430, CGS)	To Be Determined	These regulations establish permitting and monitoring requirements for discharges to surface water, groundwater, and POTWs.	Alternatives involving discharge of an aqueous waste stream will need to comply with the substantive provisions of these regulations. If the discharge is considered "off-site", permitting requirements will have to be met.

TABLE 2-1B (cont.)
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AUTHORITY	REQUIREMENT	STATUS ⁽¹⁾	REQUIREMENT SYNOPSIS	CONSIDERATION ⁽²⁾
State Regulatory Requirements (Continued)	Connecticut - Discharge of Stormwater Associated with Industrial Activity (Sec. 22a-430-1 to -8, RCSA; Sec. 22a- 430b, 22a-430, CGS)	To Be Determined	Establishes permit, monitoring, and reporting requirements for the management and discharge of storm waters.	Alternatives that result in discharge of surface run-off or precipitations will need to comply with the substantive requirements of the regulation.
Criteria, Advisories, Guidance	TSCA PCB Spill Clean-up Policy (40 CFR 761.120-135)	To Be Considered	This policy applies to recent PCB spills and establishes cleanup levels for PCB spills of 50 ppm or greater at 10 ppm for non-restricted access areas and 25 ppm for restricted access areas.	These clean-up levels may be used as guidelines for soil cleanup at the Raymark facility.
	Guidance on Remedial Actions of Superfund Sites with PCB Contamination (EPA/540/G-90/ 007, Aug. 1990)	To Be Considered	Describes various scenarios and considerations pertinent to determining the appropriate level of PCBs that can be left in each contaminated media to achieve protection of human health and environment.	This guidance will be considered in determining the appropriate level of PCBs that will be left in the soil. Management of PCB contamination residuals will be designed in accordance with the guidance.

TABLE 2-1B (cont.)
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AUTHORITY	REQUIREMENT	STATUS ⁽¹⁾	REQUIREMENT SYNOPSIS	CONSIDERATION ⁽²⁾
Criteria, Advisories, Guidance (Continued)	CAA NAAQS for particulate matter (40 CFR 50.6)	To Be Considered	The particulate matter NAAQS specifies maximum primary and secondary 24 hour concentrations for particulate matter in the ambient air. These ambient air concentrations are not designed to apply to specific sources; rather, states may promulgate State Implementation Plan emission limits applicable to sources, which would result in attainment and maintenance of the NAAQS. Connecticut has not promulgated any particulate matter emission limits applicable to this source.	Fugitive dust emissions for soil-waste handling activities would be minimized with temporary enclosures and dust suppressants, if necessary. These measures should be sufficient to prevent any exceedances in the ambient air of the 150 µg/m ³ 24-hour primary standard for particulate matter.
	U.S. EPA Technical Guidance - Final Covers of Hazardous Waste Landfills and Surface Impoundments (EPA/530-SW-89-047)	To Be Considered	Provides technical specifications for the design of multi-layer covers at landfills where hazardous wastes were disposed.	This guidance will be considered in designing any cap and associated systems.
	Proposal for the Connecticut Cleanup Standard Regulations (22a-133K CGS)	To Be Considered	The proposed regulations would define minimum hazardous waste site remediation standards, specify numeric criteria for cleanup of soils and groundwater, and specify a process for establishing alternative, site specific cleanup standards.	The proposed regulations will be considered in determining soil cleanup standards.

Notes:

1) Determination of the status of the requirement (i.e., applicable, relevant and appropriate, or to be considered) will be made for the individual alternatives and will be indicated on the alternative-specific ARARs once alternatives are developed.

2) At the screening level, assume no additional waste is brought into the study area.

CGS - Connecticut General Statutes

RCSA - Regulation of Connecticut State Agencies

TABLE 2-1C
POTENTIAL LOCATION-SPECIFIC ARARs AND TBCs
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AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE FS
Federal Regulatory Requirements	Protection of Wetlands (Executive Order 11990), 40 CFR 6.302(a) and 40 CFR 6, App. A (Policy on Implementing E.O. 11990)	To Be Considered	Federal agencies are required to avoid undertaking or providing assistance for new construction located in wetlands unless there is no practicable alternative and the proposed action includes all practicable measures to minimize harm to wetlands which may result from such use.	Remedial alternatives that involve excavation or deposition of materials in the lagoon/ wetland system would include all practicable means of minimizing harm to wetlands. Wetlands protection consideration would be incorporated into the planning and decision-making for remedial alternatives.
	Floodplain Management (Executive Order 11988, 40 CFR 6.302(b) and 40 CFR 6, App. A (Policy on Implementing E.O. 11988)	To Be Considered	Federal agencies are required to avoid impacts associated with the occupancy and modification of a floodplain and avoid support of floodplain development wherever there is a practicable alternative.	The potential effects on the floodplain will be considered during the development and evaluation of remedial alternatives. All practicable measures would be taken to minimize adverse effects on floodplains.
	RCRA Floodplain Restrictions for Hazardous Waste Facilities (40 CFR 264.18(b))	To Be Considered	A hazardous waste facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout or to result in no adverse effects on human health or the environment if washout were to occur.	The remedial alternatives must ensure that the hazardous waste facilities located in the floodplain would comply with these requirements.
	CWA - Dredge and Fill Regulations (40 CFR 230; 33 CFR 320-330)	To Be Considered	These regulations, also known as the CWA Section 404(b)(i) Guidelines, outline requirements for the discharge of dredged or fill materials into surface waters, including wetlands. Under these requirements, no activity that impacts a wetland shall be permitted if a practicable alternative, which would have less adverse impact, exists.	Controls would be used to minimize adverse impacts to the wetlands.
	Fish and Wildlife Coordination Act (16 U.S.C. 661)	To Be Considered	This regulation requires that any Federal agency that proposes to modify a body of water must take action to prevent, mitigate or compensate for project-related losses of fish and wildlife resources.	Controls would be used to minimize adverse impacts to the wetlands. EPA would ensure that losses to fish and wildlife resources are prevented, mitigated or compensated and that the U.S. Fish and Wildlife Service would be consulted.
	Endangered Species Act (16 USC 1531 <u>et seq.</u> ; 40 CFR 6.302(h))	To Be Considered	This statute requires that Federal agencies avoid activities which jeopardize threatened or endangered species or adversely modify habitats essential to their survival. Mitigation measures should be considered if a listed species or habitat may be jeopardized.	Construction of the collection and containment systems would be conducted to ensure that any listed species or habitat identified in the area of the site would not be adversely affected.

TABLE 2-1C (cont.)
POTENTIAL LOCATION-SPECIFIC ARARs AND TBCs
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AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE FS
Federal Regulatory Requirements (cont'd)	An Act Relating to the Preservation of Historical and Archeological Data (16 USC 469a-1)	To Be Considered	This statute requires that, whenever any Federal agency finds or is made aware that its activity in connection with any construction project or federally licensed project, activity or program may cause irreparable loss or destruction of significant scientific, prehistorical, historical, or archeological data, such agency shall undertake the recovery, protection and preservation of such data or notify the Secretary of Interior. The undertaking could include a preliminary survey (or other investigation as needed) and analysis and publication of the reports resulting from such investigation.	If significant scientific, prehistorical, historical, or archeological data are encountered during soil excavation, steps would be implemented to recover, protect and preserve such data.
	Archeological Resources Protection Act (16 USC 470aa-mm, 36 CFR 296, 32 CFR 229, 43 CFR7, and 18 CFR 1312)	To Be Considered	This regulation develops procedures for the protection of archeological resources.	If archeological resources are encountered during soil excavation, they would be reviewed by Federal and State archaeologists. This requirement is applicable to any excavation onsite.
Criteria, Advisories, Guidance	U.S. EPA Memorandum, "Policy on Floodplains and Wetland Assessments for CERCLA Actions" (Aug. 6, 1985)	To Be Considered	This guidance discusses situations that require preparation of a floodplains or wetlands assessment, and the factors which should be considered in preparing an assessment, for response actions undertaken pursuant to section 104 or 106 of CERCLA.	This guidance will be considered during the development, evaluation and selection of alternatives that involve disturbance, alteration or destruction of floodplains or wetlands.
	Memorandum of Agreement (MOA) between EPA and the U.S. Department of the Army	To Be Considered	This notice provides clarification and general guidance regarding the level of mitigation necessary to demonstrate compliance with the Clean Water Act section 404(b)(1) Guidelines.	This guidance will be considered during the development, evaluation and selection of alternatives that involve disturbance, alteration or destruction of wetlands.

TABLE 2-1C (cont.)
 POTENTIAL LOCATION-SPECIFIC ARARs AND TBCs
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AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE FS
	Guidance on Flexibility of the 404(b)(1) Guidelines	To Be Considered	This document provides guidance on the flexibility that the U.S. Army Corps of Engineers should be utilizing when making determinations of compliance with the Section 404(b)(1) Guidelines, and guidance on the use of mitigation banks as a means of providing compensatory mitigation for Corps regulatory decisions.	This guidance will be considered during the development, evaluation and selection of alternatives that involve disturbance, alteration or destruction of wetlands.

TABLE 2-2A
SUMMARY OF TOTAL RISK LEVELS AND HAZARD INDICES
AREA A-1 COMMERCIAL ALL SOILS
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Contaminant of Concern	Representative Concentration For The RME Receptor	Incremental Lifetime Cancer Risk Levels for RME Receptor Commercial Worker			Hazard Quotients for RME Receptor Commercial Worker		
		Incidental Ingestion	Dermal Contact	All Pathways	Incidental Ingestion	Dermal Contact	All Pathways
SVOCs (mg/kg)							
Benzo(a)pyrene	2	5.1E-06	3.3E-06	8.4E-06	NA	NA	NA
PCBs (mg/kg)							
Aroclor, Total	8.8	6.2E-06	4.3E-06	1.1E-05	6.4E-03	4.5E-03	1.1E-02
Metals (mg/kg)							
Arsenic	18.4	9.6E-06	1.4E-06	1.1E-05	6.0E-02	9.0E-03	6.9E-02
Lead	674	NA	NA	NA	NA	NA	NA
Dioxins (mg/kg)							
Dioxin TEQ	0.002	1.2E-04	1.7E-05	1.4E-04	NA	NA	NA

ABBREVIATIONS:

NA - Not Available

RL - Risk Level

CRL - Cancer Risk Level

HI - Hazard Index

RME - Reasonable Maximum Exposure

Total RL =	1.4E-04	2.6E-05	1.7E-04	6.6E-02	1.4E-02	8.0E-02
Total RME CRL = Incidental Ingestion + Dermal Contact =	1.7E-04					
Total RME HI = Incidental Ingestion + Dermal Contact =	8.0E-02					

NOTES: Risk levels and hazard indices are for incidental ingestion and dermal contact by an individual worker according to future land use scenarios.

TABLE 2-2B
SUMMARY OF TOTAL RISK LEVELS AND HAZARD INDICES
AREA A-1 COMMERCIAL SURFACE SOILS
DRAFT TECHNICAL MEMORANDUM
REMEDIAL ALTERNATIVES SCREENING
RAYMARK - OU3
STRATFORD, CONNECTICUT

Contaminant of Concern	Representative Concentration For The RME Receptor	Incremental Lifetime Cancer Risk Levels for RME Receptor Commercial Worker			Hazard Quotients for RME Receptor Commercial Worker		
		Incidental Ingestion	Dermal Contact	All Pathways	Incidental Ingestion	Dermal Contact	All Pathways
SVOCs (mg/kg)							
Benzo(a)pyrene	6	1.5E-05	9.9E-06	2.5E-05	NA	NA	NA
PCBs (mg/kg)							
Aroclor, Total	410	2.9E-04	2.0E-04	4.9E-04	NA	NA	NA
Metals (mg/kg)							
Arsenic	21.9	1.1E-05	1.7E-06	1.3E-05	7.1E-02	1.1E-02	8.2E-02
Lead	1160	NA	NA	NA	NA	NA	NA
Dioxins (mg/kg)							
Dioxin TEQ	0.0175	9.2E-04	1.4E-04	1.1E-03	NA	NA	NA

ABBREVIATIONS:

NA - Not Available

RL - Risk Level

CRL - Cancer Risk Level

HI - Hazard Index

RME - Reasonable Maximum Exposure

Total RL =	1.2E-03	3.5E-04	1.6E-03	7.1E-02	1.1E-02	8.2E-02
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Total RME CRL = Incidental Ingestion + Dermal Contact =	1.6E-03
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Total RME HI = Incidental Ingestion + Dermal Contact =	8.2E-02
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TABLE 2-2C
SUMMARY OF TOTAL RISK LEVELS AND HAZARD INDICES
AREA A-1 RECREATIONAL SURFACE SOILS
DRAFT TECHNICAL MEMORANDUM
REMEDIAL ALTERNATIVES SCREENING
RAYMARK - OU3
STRATFORD, CONNECTICUT

Contaminant of Concern	Representative Concentration For The RME Receptor	Incremental Lifetime Cancer Risk Levels for RME Receptor Child Frequent Recreational User			Hazard Quotients for RME Receptor Child Frequent Recreational User		
		Incidental Ingestion	Dermal Contact	All Pathways	Incidental Ingestion	Dermal Contact	All Pathways
Metals (mg/kg)							
Lead	478	NA	NA	NA	NA	NA	NA

ABBREVIATIONS:

NA - Not Available

RL - Risk Level

CRL - Cancer Risk Level

HI - Hazard Index

RME - Reasonable Maximum
Exposure

Total RL =	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
------------	---------	---------	---------	---------	---------	---------

Total RME CRL = Incidental Ingestion + Dermal Contact =	0.0E+00
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Total RME HI = Incidental Ingestion + Dermal Contact =	0.0E+00
--	---------

TABLE 2-2D
SUMMARY OF TOTAL RISK LEVELS AND HAZARD INDICES
AREA A-2 COMMERCIAL ALL SOILS
DRAFT TECHNICAL MEMORANDUM
REMEDIAL ALTERNATIVES SCREENING
RAYMARK - OU3
STRATFORD, CONNECTICUT

Contaminant of Concern	Representative Concentration For The RME Receptor	Incremental Lifetime Cancer Risk Levels for RME Receptor Commercial Worker			Hazard Quotients for RME Receptor Commercial Worker		
		Incidental Ingestion	Dermal Contact	All Pathways	Incidental Ingestion	Dermal Contact	All Pathways
SVOCs (mg/kg)							
Benzo(a)pyrene	4	1.0E-05	6.6E-06	1.7E-05	NA	NA	NA
PCBs (mg/kg)							
Aroclor, Total	31	2.2E-05	1.5E-05	3.7E-05	1.5E-02	1.0E-02	2.5E-02
Metals (mg/kg)							
Lead	1560	NA	NA	NA	NA	NA	NA
Dioxins (mg/kg)							
Dioxin TEQ	0.0021	1.1E-04	1.7E-05	1.3E-04	NA	NA	NA

ABBREVIATIONS:

NA - Not Available

RL - Risk Level

CRL - Cancer Risk Level

HI - Hazard Index

RME - Reasonable Maximum Exposure

Total RL =	1.4E-04	3.9E-05	1.8E-04	1.5E-02	1.0E-02	2.5E-02
------------	---------	---------	---------	---------	---------	---------

Total RME CRL = Incidental Ingestion + Dermal Contact =	1.8E-04
---	---------

Total RME HI = Incidental Ingestion + Dermal Contact =	2.5E-02
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NOTES: Risk levels and hazard indices are for incidental ingestion and dermal contact by an individual worker according to future land use scenarios.

TABLE 2-2E
SUMMARY OF TOTAL RISK LEVELS AND HAZARD INDICES
AREA A-3 RECREATIONAL SURFACE SOILS/SEDIMENTS
DRAFT TECHNICAL MEMORANDUM
REMEDIAL ALTERNATIVES SCREENING
RAYMARK - OU3
STRATFORD, CONNECTICUT

Contaminant of Concern	Representative Concentration For The RME Receptor	Incremental Lifetime Cancer Risk Levels for RME Receptor Child Frequent Recreational User			Hazard Quotients for RME Receptor Child Frequent Recreational User		
		Incidental Ingestion	Dermal Contact	All Pathways	Incidental Ingestion	Dermal Contact	All Pathways
Metals (mg/kg)							
Lead	1280	NA	NA	NA	NA	NA	NA

ABBREVIATIONS:

NA - Not Available

RL - Risk Level

CRL - Cancer Risk Level

HI - Hazard Index

RME - Reasonable Maximum
Exposure

Total RL =	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
------------	---------	---------	---------	---------	---------	---------

Total RME CRL = Incidental Ingestion + Dermal Contact =	0.0E+00
---	---------

Total RME HI = Incidental Ingestion + Dermal Contact =	0.0E+00
--	---------

TABLE 2-3
SOIL/SEDIMENT CONTAMINANTS OF CONCERN
DRAFT TECHNICAL MEMORANDUM
REMEDIAL ALTERNATIVES SCREENING
RAYMARK – OU3
STRATFORD, CONNECTICUT

CONTAMINANTS OF CONCERN	HUMAN CARCINOGEN COC ⁽¹⁾	HUMAN NON-CARCINOGEN COC ⁽¹⁾
SEMI-VOLATILE ORGANIC COMPOUNDS		
Benzo(a)pyrene	X	-
PCBs		
Aroclor (total)	X	X
INORGANICS		
Arsenic	X	X
Asbestos	(2)	(2)
Lead	(2)	(2)
DIOXINS		
Dioxin TEQs	X	-

Notes:

- 1) Human COCs selected if exposure causes cancer risk in excess of 1×10^{-5} for carcinogens, or has a Hazard Quotient of greater than 1.0 for non-carcinogens.
- 2) Asbestos and lead pose carcinogenic and non-carcinogenic health threats; there is insufficient risk data to quantify health risks. However, both are retained as human health COCs.

COC = Contaminant of concern

TABLE 2-4
POTENTIAL SOIL/SEDIMENT PRELIMINARY REMEDIATION GOALS FOR CONTAMINANTS OF CONCERN
DRAFT TECHNICAL MEMORANDUM
REMEDIAL ALTERNATIVES SCREENING
RAYMARK – OU3
STRATFORD, CONNECTICUT

Contaminant	Risk-Based (1)	Conn. Pollutant Mobility Criteria (2)	Background (3)	CRQL/CRDL (4)	ARARs/TBCs
Semi-volatile Organic Compounds (mg/kg)					
Benzo(a)pyrene	2.376	1	NA	0.33	NA
PCBs (mg/kg)					
Aroclor (total)	8.416	0.005 mg/L +	NA	0.033	25 (5)
Inorganics (mg/kg)					
Arsenic	16.6	0.5 mg/L +	5.7	2	NA
Asbestos	NA	NA	NA	---	1% (6)
Lead	NA	0.15 mg/L +	8.1	0.6	400/1000 (7)
Dioxins (mg/kg)					
Dioxin TEQs	0.0002	NA	NA	NA	0.001(8)

NOTES:

NA Not applicable

--- Not available

+ Value is in mg/L and should be compared to TCLP or SPLP analyses presented in the RI.

(1) Risk-based PRG values were developed for the protection of human health. Only commercial values were calculated.

(2) Numeric criteria from the Remediation Standard Regulations, Connecticut Department of Environmental Protection. Value is for Pollutant Mobility for GB aquifer areas. For PCBs and inorganic contaminants, the value is the Pollutant Mobility Criteria for GB groundwater by TCLP or SPLP in mg/L.

(3) Background soil and sediment concentrations were calculated for metals based on mean values.

(4) EPA Contract Laboratory Program Contract Required Quantitation Limit (CRQL) and Contract Required Detection Limit (CRDL) values for organics and inorganics, respectively.

(5) OSWER Directive No. 9355.4-01, Guidance on Remedial Actions for Superfund Sites with PCB Contamination, August 1990 suggests an acceptable value of 25 mg/kg PCBs for commercial sites.

(6) NESHAPs - 40 CFR Section 61, subsection M identifies materials containing 1 percent or greater asbestos would need to be addressed in accordance with regulations.

(7) A PRG value of 400 mg/kg is recommended for recreational soils in Area A1 and soils and sediment in Area A3; a value of 1,000 mg/kg is recommended for commercial area soils in Areas A1 and A2 (OSWER Directive No. 9355.4-12, Revised Interim Guidance on Establishing Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities, July 1994).

(8) OSWER Directive No. 9200.4-26, Approaches for Addressing Dioxins in Soil at CERCLA and RCRA Sites, April 1998, presents a 0.001 mg/kg dioxin cleanup level.

TABLE 2-5
SELECTED SOIL/SEDIMENT PRELIMINARY REMEDIATION GOALS
DRAFT TECHNICAL MEMORANDUM
REMEDIAL ALTERNATIVES SCREENING
RAYMARK – OU3
STRATFORD, CONNECTICUT

Contaminant	Preliminary Remediation Goal	Basis of Selection
Semi-volatile Organic Compounds (mg/kg)		
Benzo(a)pyrene	2.376	Risk-based
PCBs (mg/kg)		
Aroclor (total)	25	ARAR/TBC
Inorganics (mg/kg)		
Arsenic	16.6	Risk-based
Asbestos	1%	ARAR/TBC
Lead(1)	400/1,000	ARAR/TBC
Dioxins		
Dioxin TEQs	0.001	ARAR/TBC

- (1) A PRG of 400 mg/kg is recommended for soils in the recreational area bordering homes in Area A1 and soil and sediment in Area A-3. A PRG of 1,000 mg/kg is recommended for soils in the remaining commercial areas of Area I.

TABLE 2-6
RAOs, GRAs, TECHNOLOGIES AND PROCESS OPTIONS
DRAFT TECHNICAL MEMORANDUM
REMEDIAL ALTERNATIVES SCREENING
RAYMARK - OU3
STRATFORD, CONNECTICUT

REMEDIAL ACTION OBJECTIVES	GENERAL RESPONSE ACTIONS	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS
ENVIRONMENTAL MEDIUM: SOILS			
PROTECTION OF HUMAN HEALTH	No Action	No Action	Not Applicable
PROTECTION OF ECOLOGICAL RECEPTORS	Limited Action	Limited Action Technologies <ul style="list-style-type: none"> - Institutional Controls - Access Restrictions - Long-Term Monitoring 	<ul style="list-style-type: none"> - Deed Restrictions - Local Ordinances - Fencing - Post Signs - Groundwater Monitoring
PROTECTION OF GROUNDWATER	Soil Removal	Removal Technologies <ul style="list-style-type: none"> - Excavation 	<ul style="list-style-type: none"> - Bulk Mechanical Excavation
	Soil Disposal	Disposal Technologies <ul style="list-style-type: none"> - Landfill 	<ul style="list-style-type: none"> - Landfill (off-site) - Landfill (on-site)
	Soil Containment	Containment Technologies <ul style="list-style-type: none"> - Horizontal Barriers - Vertical Barriers 	<ul style="list-style-type: none"> - Impermeable Cap - Permeable Soil Cover - Sheet Pile - Slurry Wall

TABLE 2-6 (cont.)
 RAOs, GRAs, TECHNOLOGIES AND PROCESS OPTIONS
 DRAFT TECHNICAL MEMORANDUM
 REMEDIAL ALTERNATIVES SCREENING
 RAYMARK - OU3
 STRATFORD, CONNECTICUT
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REMEDIAL ACTION OBJECTIVES	GENERAL RESPONSE ACTIONS	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS
	Soil Treatment	Treatment Technologies <ul style="list-style-type: none"> - Immobilization - Thermal Treatment - Physical Treatment - Chemical Treatment - Biological Treatment 	<ul style="list-style-type: none"> - Solidification/Stabilization - Microencapsulation - Incineration - Pyrolysis - Thermal Desorption - Super Critical Water Oxidation - Vitrification - Soil Flushing - Soil Washing - Liquefied Gas Solvent Extraction - Soil Vapor Extraction - Electrokinetics - Chemical Dechlorination - Chemical Oxidation - Solvent Extraction - Aerobic Biodegradation - Anaerobic Biodegradation - Phytoremediation

TABLE 2-6 (cont.)
 RAOs, GRAs, TECHNOLOGIES AND PROCESS OPTIONS
 DRAFT TECHNICAL MEMORANDUM
 REMEDIAL ALTERNATIVES SCREENING
 RAYMARK - OU3
 STRATFORD, CONNECTICUT
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REMEDIAL ACTION OBJECTIVES	GENERAL RESPONSE ACTIONS	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS
ENVIRONMENTAL MEDIUM: WETLAND SOILS			
PROTECTION OF HUMAN HEALTH	No Action	No Action	Not Applicable
PROTECTION OF ECOLOGICAL RECEPTORS	Limited Action	Limited Action Technologies <ul style="list-style-type: none"> - Institutional Controls - Access Restrictions - Long-Term Monitoring 	<ul style="list-style-type: none"> - Deed Restrictions - Local Ordinances - Fencing - Post Signs - Groundwater Monitoring
PROTECTION OF GROUNDWATER	Wetland Soil Removal	Removal Technologies <ul style="list-style-type: none"> - Excavation - Dredging 	<ul style="list-style-type: none"> - Bulk Mechanical Excavation - Mechanical Dredging - Hydraulic Dredging - Pneumatic Dredging
	Wetland Soil Disposal	Disposal Technologies	<ul style="list-style-type: none"> - Landfill (on-site) - Landfill (off-site)
	Wetland Soil Containment	Containment Technologies <ul style="list-style-type: none"> - Horizontal Barriers - Vertical Barriers 	<ul style="list-style-type: none"> - Impermeable Cap - Permeable Soil Cover - Sheet Pile - Slurry Wall

TABLE 2-6 (cont.)
 RAOs, GRAs, TECHNOLOGIES AND PROCESS OPTIONS
 DRAFT TECHNICAL MEMORANDUM
 REMEDIAL ALTERNATIVES SCREENING
 RAYMARK - OU3
 STRATFORD, CONNECTICUT
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REMEDIAL ACTION OBJECTIVES	GENERAL RESPONSE ACTIONS	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS
Cont'd	Wetland Soil Treatment	Treatment Technologies <ul style="list-style-type: none"> - Immobilization - Thermal Treatment - Physical Treatment - Chemical Treatment - Biological Treatment 	<ul style="list-style-type: none"> - Solidification/Stabilization - Microencapsulation - Sorption - Incineration - Pyrolysis - Thermal Desorption - Super Critical Water Oxidation - Vitrification - Soil Flushing - Soil Washing - Liquefied Gas Solvent Extraction - Soil Vapor Extraction - Electrokinetics - Chemical Dechlorination - Chemical Oxidation - Solvent Extraction - Aerobic Biodegradation - Anaerobic Biodegradation - Phytoremediation

TABLE 2-6 (cont.)
RAOs, GRAs, TECHNOLOGIES AND PROCESS OPTIONS
DRAFT TECHNICAL MEMORANDUM
REMEDIAL ALTERNATIVES SCREENING
RAYMARK - OU3
STRATFORD, CONNECTICUT
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REMEDIAL ACTION OBJECTIVES	GENERAL RESPONSE ACTIONS	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS
ENVIRONMENTAL MEDIUM: FERRY CREEK SEDIMENTS			
PROTECTION OF HUMAN HEALTH	No Action	No Action	Not Applicable
PROTECTION OF ECOLOGICAL RECEPTORS	Limited Action	Limited Action Technologies <ul style="list-style-type: none"> - Institutional Controls - Access Restrictions - Long-Term Monitoring 	<ul style="list-style-type: none"> - Deed Restrictions - Local Ordinances - Post Signs - Fencing - Groundwater Monitoring
PROTECTION OF GROUNDWATER	Sediment Removal	Removal Technologies <ul style="list-style-type: none"> - Excavation - Dredging 	<ul style="list-style-type: none"> - Bulk Mechanical Excavation - Mechanical Dredging - Hydraulic Dredging - Pneumatic Dredging
	Sediment Disposal	Disposal Technologies	<ul style="list-style-type: none"> - Landfill (off-site) - Landfill (on-site)
	Sediment Containment	Containment Technologies <ul style="list-style-type: none"> - Horizontal Barriers - Vertical Barriers - Culvert 	<ul style="list-style-type: none"> - Impermeable Cap - Permeable Soil/Rock Cover - Culvert Ferry Creek

TABLE 2-6 (cont.)
 RAOs, GRAs, TECHNOLOGIES AND PROCESS OPTIONS
 DRAFT TECHNICAL MEMORANDUM
 REMEDIAL ALTERNATIVES SCREENING
 RAYMARK - OU3
 STRATFORD, CONNECTICUT
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REMEDIAL ACTION OBJECTIVES	GENERAL RESPONSE ACTIONS	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS
Cont'd	Sediment Treatment	Treatment Technologies <ul style="list-style-type: none"> - Immobilization - Thermal Treatment - Physical Treatment - Chemical Treatment - Biological Treatment 	<ul style="list-style-type: none"> - Solidification/Stabilization - Microencapsulation - Sorption - Incineration - Pyrolysis - Thermal Desorption - Super Critical Water Oxidation - Vitrification - Soil Flushing - Soil Washing - Liquefied Gas Solvent Extraction - Soil Vapor Extraction - Electrokinetics - Chemical Dechlorination - Chemical Oxidation - Solvent Extraction - Aerobic Biodegradation - Anaerobic Biodegradation - Phytoremediation

TABLE 2-7
SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
DRAFT TECHNICAL MEMORANDUM
REMEDIAL ALTERNATIVES SCREENING
RAYMARK - OU3
STRATFORD, CONNECTICUT

GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: SOILS (Areas A-1, A-2, A-3)					
No Action	No Action	Not Applicable	No Action	Retained. Used as baseline for comparison with other options as required by NCP. Low cost.	Common Approach
Limited Action	Institutional Controls	Deed Restrictions	Administrative action used to restrict future site activities on individual properties. Restrictions would prevent activities such as excavation or residential development.	Retained for protection of human health. Not protective of ecological receptors or groundwater. Low cost.	Common Approach
		Local Ordinances	Administrative action used to limit property use and activities such as well installation.	Retained for protection of human health. Not protective of ecological receptors or groundwater. Low cost.	Common Approach
	Access Restrictions	Fencing	Barrier erected to restrict access to contaminated properties.	Retained for protection of human health. Not protective of ecological receptors or groundwater. Low cost.	Common Approach
		Post Signs	Post "No Trespassing" or hazard warning signs.	Retained for protection of human health. Not protective of ecological receptors or groundwater. Low cost.	Common Approach
	Long-Term Monitoring	Monitoring	Periodic monitoring events to determine whether soils, sediments, wetland soils, surface water, or groundwater are a continuing source of contamination.	Retained because there will be no removal of contaminants. Can be combined with other GRAs for continued assessment of existing site conditions. Moderate cost.	Common Approach

TABLE 2-7 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
DRAFT TECHNICAL MEMORANDUM
REMEDIAL ALTERNATIVES SCREENING
RAYMARK - OU3
STRATFORD, CONNECTICUT
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GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: SOILS (Areas A-1, A-2, A-3)					
Soil Removal	Excavation	Bulk Mechanical Excavation	Use of common construction equipment to remove contaminated soil. Addresses soil above the groundwater table.	Retained for protection of human health and protection of ecological receptors. This option alone may not be protective of groundwater if contamination is present below groundwater table. Effective for all site contaminants. Moderate cost.	Common Approach
Soil Disposal	Disposal	Out-of-Town Landfill	Transport and disposal of untreated soil to an approved out-of-town landfill.	Retained as potentially effective. Must be reviewed in concert with excavation technology. Moderate to high cost.	Common Approach
		In-Town Landfill	Disposal of untreated soil in a specially constructed landfill within the City of Stratford.	Retained as potentially effective. May not be feasible for entire volume of contaminated soil as area is comprised of numerous small parcels. Must be reviewed in concert with excavation technology. Low cost.	Common Approach
Soil Containment	Horizontal Barriers	Impermeable Cap	Asphalt, concrete, geosynthetics, or multi-media materials are used to form an impermeable barrier to prevent direct contact with contaminated soil and to minimize leaching of contaminants from soil to groundwater.	Retained for protection of human health and protection of ecological receptors. Moderate cost.	Common Approach
		Permeable Cover	Soil, crushed stone, geosynthetics and vegetative cover used to prevent direct contact with contaminated soil and minimize erosion and surface migration of contaminated soil.	Retained as potentially applicable for protection of human health and ecological receptors. Not protective of groundwater. Low cost.	Common Approach


 Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
 PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
 DRAFT TECHNICAL MEMORANDUM
 REMEDIAL ALTERNATIVES SCREENING
 RAYMARK - OU3
 STRATFORD, CONNECTICUT
 PAGE 3 OF 27

GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: SOILS (Areas A-1, A-2, A-3)					
Soil Containment (cont'd)	Vertical Barriers	Sheet Pile Wall	Steel sheet piles are used to construct a vertical barrier, or wall, around contaminated areas to isolate contaminated soils and groundwater and prevent migration.	Eliminated. Typically used to control migration of groundwater. Limited usefulness with soil. Not protective of human health and ecological receptors. Low cost.	Well Established
		Slurry Wall	A vertical barrier consisting of low permeability material is constructed around contaminated areas to isolate contaminated soils and groundwater and prevent migration.	Eliminated. Typically used to control migration of groundwater. Limited usefulness with soil. Not protective of human health and ecological receptors. Low cost.	Well Established
Soil Treatment	Immobilization	Solidification/Stabilization	Soil mixing equipment used to mix reagents with contaminated soil to physically and/or chemically decrease the mobility of contaminants. Potential reagents include cement, pozzolanic material, thermoplastics, polymers and asphalt. Treatment may be done in situ or ex situ.	Retained as potentially effective. Demonstrated to be effective with metals and other inorganic (asbestos) and organic (SVOCs, PCBs) contaminants. Moderate cost.	Well Established
		Microencapsulation	Contaminated material is encapsulated by containers or inert and impervious coatings that will minimize leaching. Treatment will be done ex situ.	Eliminated. Effectively isolates all site contaminants but no treatment occurs. Not feasible in cases involving large quantities of contaminated material. High cost.	Not Well Established


 Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
DRAFT TECHNICAL MEMORANDUM
REMEDIAL ALTERNATIVES SCREENING
RAYMARK - OU3
STRATFORD, CONNECTICUT
PAGE 4 OF 27

GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: SOILS (Areas A-1, A-2, A-3)					
Soil Treatment (cont'd)	Thermal Treatment	Incineration	Destruction of organic contaminants by subjecting them to high temperatures under controlled conditions in a combustion chamber. Treatment will be done ex situ.	Eliminated. Effective for organic contaminants (SVOCs, PCBs) but not effective for inorganic contaminants (metals, asbestos). Not easily undertaken within the town of Stratford, on or off site. High cost.	Well Established
		Pyrolysis	Chemical decomposition of organic contaminants by heating the material in the absence of oxygen. Treatment will be done ex situ.	Eliminated. Effective for organic contaminants (SVOCs, PCBs) but not effective for inorganic contaminants (metals, asbestos). Not easily undertaken within the town of Stratford, on- or off site. High cost.	Not Well Established
		Thermal Desorption	Air, heat and mechanical agitation are used to volatilize organic contaminants from soil into a vapor stream. Vapor is usually further treated. Treatment will be done ex situ.	Retained for potential use at an in-town location. Eliminated for use at and out-of-town location. Effective for organic contaminants (SVOCs, PCBs) but not effective for inorganic contaminants (metals, asbestos). May be used as part of a treatment train. Moderate cost.	Well Established
		Supercritical Water Oxidation	Contaminated soil is exposed to water in a high temperature, high pressure environment. Under such conditions, organic substances are oxidized. Treatment will be done ex situ.	Eliminated. Effective for some organic contaminants (SVOCs) but not effective for inorganic contaminants (metals, asbestos) and PCBs. High cost.	Not Well Established

 Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
DRAFT TECHNICAL MEMORANDUM
REMEDIAL ALTERNATIVES SCREENING
RAYMARK - OU3
STRATFORD, CONNECTICUT
PAGE 5 OF 27

GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: SOILS (Areas A-1, A-2, A-3)					
Soil Treatment (cont'd)		Vitrification	Melting of contaminated material to volatilize or pyrolyze organics and entrain inorganics in a stable vitreous residual. Treatment may be done in situ or ex situ.	Retained. Potentially effective for all site contaminants. High cost.	Well Established
	Physical Treatment	Soil Flushing	Contaminants sorbed to soil are mobilized or dissolved in an aqueous flushing solution in situ. The flushing solution is then extracted from the subsurface and treated. Flushing solution may be augmented by chemicals which increase the mobilization or dissolution of organics and some heavy metals from the soil. Treatment will be done in situ.	Eliminated. Difficult to ensure capture of flushing solution due to shallow water table. Not a reliable method in cases involving multiple types of contaminants. Moderate cost.	Well Established
		Soil Washing	Process reduces the amount of contaminated material by two means. Finer particles, which contain the bulk of contaminants, are separated from more coarse material. Contaminants sorbed to soil are dissolved in an aqueous washing solution. The wash water may be augmented by chemicals which increase the leaching of organics and some heavy metals from the soil. Treatment may be done in situ or ex situ.	Retained. Potentially effective for organics (SVOCs, PCBs) and some inorganics (metals, asbestos), but multiple washing steps may be necessary. Washing solution would need to be recovered and treated. Not a reliable method in cases involving multiple types of contaminants. May be used as part of a "treatment train". Can be done on or off site within Stratford. Moderate to high cost.	Well Established


 Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
DRAFT TECHNICAL MEMORANDUM
REMEDIAL ALTERNATIVES SCREENING
RAYMARK - OU3
STRATFORD, CONNECTICUT
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GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: SOILS (Areas A-1, A-2, A-3)					
Soil Treatment (cont'd)		Liquefied Gas Solvent Extraction	Liquefied gas solvents, such as propane, are used to extract organics from soil. Treatment will be done in situ.	Eliminated. Technology is not commercially available and effectiveness is not well established. Cost information not available.	Not Well established
		Soil Vapor Extraction	In situ technology in which vacuum blowers and extraction wells are used to strip volatile organic compounds from unsaturated soil. Treatment will be done in situ.	Eliminated. Only effective for volatile organic compounds (VOCs) in non-saturated soils. Not effective for SVOCs, metals, PCBs, asbestos. Moderate cost.	Well Established
		Electrokinetics	Electrodes are used to manipulate soil conditions to recover or destroy organics and metals. Treatment will be done in situ.	Eliminated. Potentially effective for organic (SVOCs, PCBs) and some inorganics (metals) but not effective for asbestos. Less effective in cases involving shallow water table. Cost information not available.	Not Well Established
	Chemical Treatment	Chemical Dechlorination	Chlorine atoms are stripped from chlorinated contaminants through chemical reactions to produce less toxic byproducts. These byproducts are generally more amenable to biodegradation. Treatment will be done ex situ.	Eliminated. Only addresses chlorinated compounds (PCBs). PCBs are very stable - may be resistant to dechlorination. Not effective for non-chlorinated organics (SVOCs) or inorganics (metals, asbestos). Cost information not available.	Not Well Established

 Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
 PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
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GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: SOILS (Areas A-1, A-2, A-3)					
Soil Treatment (cont'd)		Chemical Oxidation	Oxidants are injected into the subsurface where they react with contaminants to form harmless end products. Can be used to remediate a wide range of organic contaminants. Treatment will be done in situ.	Eliminated. Generally used for treatment of groundwater. Does not address inorganic contaminants (metals, asbestos). PCBs may be difficult to oxidize. Moderate cost.	Well Established
		Solvent Extraction	Chemical desorption and dissolution of organic and some inorganic contaminants by washing soil with a solvent solution. Treatment will be done ex situ.	Eliminated. Not effective for wastes with multiple contaminant types. Not effective for asbestos. Solvent solution would need to be recovered and treated. Moderate cost.	Well Established
	Biological Treatment	Aerobic Biodegradation	Microorganisms degrade organic contaminants to carbon dioxide and water. Oxygen is used as an electron acceptor in the degradation process. Treatment may be done in situ or ex situ.	Eliminated. Effectiveness is limited to certain organic contaminants. Metals, PCBs, and asbestos are generally not amenable to biological treatment. Low cost.	Well Established


 Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
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GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: SOILS (Areas A-1, A-2, A-3)					
		Phytoremedia- tion	Plants are used to naturally remediate contaminants via three mechanisms: direct uptake and accumulation of contaminants in plant tissue, release of enzymes that stimulate microbial activity and biochemical transformation, and enhancement of mineralization in plants' roots. Effective for destruction of some VOCs and SVOCs and effective for absorbing many inorganics. Not demonstrated as effective for PCBs. Treatment will be done in situ.	Eliminated . Potentially effective for metals, SVOCs; not effective for asbestos, PCBs. Root systems of plants may not extend deep enough to remediate contaminants at depth. Plants would require harvesting, proper disposal, and replanting. Reliable cost information not available.	Not Well Established
Consolidation	Consolidation	Consolidation	Transport and consolidation of contaminated material at an in-town location.	Retained. Must be reviewed in concert with excavation technology. Low cost.	Well Established
Other					

 Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
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GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: WETLAND SOILS (Areas A-1, A-3)					
No Action	No Action	Not Applicable	No Action	Retained. Used as baseline for comparison with other options as required by NCP. Low cost.	Common Approach
Limited Action	Institutional Controls	Deed Restrictions	Administrative action used to restrict future site activities on individual properties. Restrictions would prevent activities such as excavation or residential development.	Retained for protection of human health. Not protective of ecological receptors or groundwater. Low cost.	Common Approach
		Local Ordinances	Administrative action used to limit property use and activities such as well installation.	Retained for protection of human health. Not protective of ecological receptors or groundwater. Low cost.	Common Approach
	Access Restrictions	Fencing	Barrier erected to restrict access to contaminated properties.	Retained for protection of human health. Not protective of ecological receptors or groundwater. Low cost.	Common Approach
		Post Signs	Post "No Trespassing" or hazard warning signs.	Retained for protection of human health. Not protective of ecological receptors or groundwater. Low cost.	Common Approach
	Long-Term Monitoring	Monitoring	Periodic monitoring events to determine whether soils, sediments, wetland soils, surface water, or groundwater are a continuing source of contamination.	Retained because there will be no removal of contaminants. Can be combined with other GRAs for continued assessment of existing site conditions. Moderate cost.	Common Approach

 Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
 PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
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GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: WETLAND SOILS (Areas A-1, A-3)					
Wetland Soil Removal	Excavation	Bulk Mechanical Excavation	Use of common construction equipment to remove contaminated material.	Retained as potentially effective for protection of human health and protection of ecological species. Dewatering of saturated material and water treatment will be required. Effective for all site contaminants. Moderate to high cost.	Common Approach
		Dredging	Mechanical dredging equipment may be used to remove saturated material.	Retained as potentially effective for protection of human health and protection of ecological species. Dewatering of saturated material and water treatment will be required. Effective for all site contaminants. Moderate to high cost.	Well Established
Wetland Soil Disposal	Disposal	Out-of-Town Landfill	Transport and disposal of untreated soil to an approved out-of-town landfill.	Retained as potentially effective. Must be reviewed in concert with excavation/dredging technology. Material may require stabilization prior to transport and disposal. Moderate to high cost.	Common Approach
		In-Town Landfill	Disposal of untreated soil in a specially constructed landfill within the City of Stratford.	Retained as potentially effective. May not be feasible for entire volume of contaminated material as area is comprised of numerous small parcels. Must be reviewed in concert with excavation/dredging technology. Material may require stabilization prior	Common Approach

 Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
 PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
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GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: WETLAND SOILS (Areas A-1, A-3)					
				to transport and disposal. Low cost.	
Wetland Soil Containment	Horizontal Barriers	Impermeable Cap	Asphalt, concrete, geosynthetics, or multi-media materials are used to form an impermeable barrier to prevent direct contact with contaminated soil and to minimize leaching of contaminants from soil to groundwater.	Retained for protection of human health and protection of ecological receptors. Moderate cost.	Common Approach
		Permeable Cover	Soil, crushed stone, geosynthetics and vegetative cover used to prevent direct contact with contaminated soil and minimize erosion and surface migration of contaminated soil.	Retained as potentially effective for protection of human health and ecological receptors. Low cost.	Common Approach
Wetland Soil Containment (cont'd)	Vertical Barriers	Sheet Pile Wall	Steel sheet piles are used to construct a vertical barrier, or wall, around contaminated areas to isolate contaminated soils and groundwater and prevent migration.	Eliminated. Typically used to control migration of groundwater. Limited usefulness with soil. Not protective of human health and ecological receptors. Low cost.	Well Established
		Slurry Wall	A vertical barrier consisting of low permeability material is constructed around contaminated areas to isolate contaminated soils and groundwater and prevent migration.	Eliminated. Typically used to control migration of groundwater. Limited usefulness with soil. Not protective of human health and ecological receptors. Low cost.	Well Established


 Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
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GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: WETLAND SOILS (Areas A-1, A-3)					
Wetland Soil Treatment	Immobilization	Solidification/Stabilization	Soil mixing equipment used to mix reagents with contaminated soil to physically and/or chemically decrease the mobility of contaminants. Potential reagents include cement, pozzolanic material, thermoplastics, polymers and asphalt. Treatment may be done in situ or ex situ.	Retained as potentially effective. Demonstrated to be effective with metals and other inorganic (asbestos) and organic (SVOCs, PCBs) contaminants. Moderate cost.	Well Established
		Microencapsulation	Contaminated material is encapsulated by containers or inert and impervious coatings that will minimize leaching. Treatment will be done ex situ.	Eliminated. Effectively isolates all site contaminants but no treatment occurs. Not feasible in cases involving large quantities of contaminated material. High cost.	Not Well Established
	Thermal Treatment	Incineration	Destruction of organic contaminants by subjecting them to high temperatures under controlled conditions in a combustion chamber. Treatment will be done ex situ.	Eliminated. Effective for organic contaminants (SVOCs, PCBs) but not effective for inorganic contaminants (metals, asbestos). Not easily undertaken within the town of Stratford, on or off site. High cost.	Well Established
Wetland Soil Treatment (cont'd)		Pyrolysis	Chemical decomposition of organic contaminants by heating the material in the absence of oxygen. Treatment will be done ex situ.	Eliminated. Effective for organic contaminants (SVOCs, PCBs) but not effective for inorganic contaminants (metals, asbestos). Not easily undertaken within the town of Stratford, on or off site. High cost.	Not Well Established

 Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
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GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: WETLAND SOILS (Areas A-1, A-3)					
Wetland Soil Treatment (cont'd)		Thermal Desorption	Air, heat and mechanical agitation are used to volatilize organic contaminants from soil into a vapor stream. Vapor is usually further treated. Treatment will be done ex situ.	Retained for potential use at an in-town location. Eliminated for use at and out-of-town location. Effective for organic contaminants (SVOCs, PCBs) but not effective for inorganic contaminants (metals, asbestos). May be used as part of a treatment train. Moderate cost.	Well Established
		Supercritical Water Oxidation	Contaminated soil is exposed to water in a high temperature, high pressure environment. Under such conditions, organic substances are oxidized. Treatment will be done ex situ.	Eliminated. Effective for some organic contaminants (SVOCs) but not effective for inorganic contaminants (metals, asbestos) and PCBs. High cost.	Not Well Established
		Vitrification	Melting of contaminated material to volatilize or pyrolyze organics and entrain inorganics in a stable vitreous residual. Treatment may be done in situ or ex situ.	Retained. Potentially effective for all site contaminants. High cost.	Well Established


 Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
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GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: WETLAND SOILS (Areas A-1, A-3)					
	Physical Treatment	Soil Flushing	Contaminants sorbed to soil are mobilized or dissolved in an aqueous flushing solution in situ. The flushing solution is then extracted from the subsurface and treated. Flushing solution may be augmented by chemicals which increase the mobilization or dissolution of organics and some heavy metals from the soil. Treatment will be done in situ.	Eliminated. Difficult to ensure capture of flushing solution due to shallow water table. Not a reliable method in cases involving multiple types of contaminants. Moderate cost.	Well Established
		Soil Washing	Process reduces the amount of contaminated material by two means. Finer particles, which contain the bulk of contaminants, are separated from more coarse material. Contaminants sorbed to soil are dissolved in an aqueous washing solution. The wash water may be augmented by chemicals which increase the leaching of organics and some heavy metals from the soil. Treatment may be done in situ or ex situ.	Retained. Potentially effective for organics (SVOCs, PCBs) and some inorganics (metals, asbestos), but multiple washing steps may be necessary. Washing solution would need to be recovered and treated. Not a reliable method in cases involving multiple types of contaminants. May be used as part of a "treatment train". Can be done on or off site within Stratford. Moderate to high cost.	Well Established
		Liquefied Gas Solvent Extraction	Liquefied gas solvents, such as propane, are used to extract organics from soil. Treatment will be done in situ.	Eliminated. Technology is not commercially available and effectiveness is not well established. Cost information not available.	Not Well established

 Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
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GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: WETLAND SOILS (Areas A-1, A-3)					
		Soil Vapor Extraction	Chemical desorption and dissolution of organic and some inorganic contaminants by washing soil with a solvent solution. Treatment will be done ex situ.	Eliminated. Only effective for volatile organic compounds (VOCs) in non-saturated soils. Not effective for SVOCs, metals, PCBs, asbestos. Moderate cost.	Well Established
Wetland Soil Treatment (cont'd)		Electrokinetics	Electrodes are used to manipulate soil conditions to recover or destroy organics and metals. Treatment will be done in situ.	Eliminated. Potentially effective for organic (SVOCs, PCBs) and some inorganics (metals) but not effective for asbestos. Less effective in cases involving shallow water table. Cost information not available.	Not Well Established
	Chemical Treatment	Chemical Dechlorination	Chlorine atoms are stripped from chlorinated contaminants through chemical reactions to produce less toxic byproducts. These byproducts are generally more amenable to biodegradation. Treatment will be done ex situ.	Eliminated. Only addresses chlorinated compounds (PCBs). PCBs are very stable - may be resistant to dechlorination. Not effective for non-chlorinated organics (SVOCs) or inorganics (metals, asbestos). Cost information not available.	Not Well Established
		Chemical Oxidation	Oxidants are injected into the subsurface where they react with contaminants to form harmless end products. Can be used to remediate a wide range of organic contaminants. Treatment will be done in situ.	Eliminated. Does not address inorganic contaminants (metals, asbestos). PCBs may be difficult to oxidize. Moderate cost.	Well Established

 Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
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GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: WETLAND SOILS (Areas A-1, A-3)					
		Phytoremedia- tion	Plants are used to naturally remediate contaminants via three mechanisms: direct uptake and accumulation of contaminants in plant tissue, release of enzymes that stimulate microbial activity and biochemical transformation, and enhancement of mineralization in plants' roots. Effective for destruction of some VOCs and SVOCs and effective for absorbing many inorganics. Not demonstrated as effective for PCBs. Treatment will be done in situ.	Eliminated. Potentially effective for metals, SVOCs; not effective for asbestos, PCBs. Root systems of plants may not extend deep enough to remediate contaminants at depth. Plants would require harvesting, proper disposal, and replanting. Reliable cost information not available.	Not Well Established
Consolidation	Consolidation	Consolidation	Transport and consolidation of contaminated material at an in-town location.	Retained. Must be reviewed in concert with excavation technology. . Material may require stabilization prior to transport and disposal. Low cost.	Well Established
Other					


 Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
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GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: FERRY CREEK SEDIMENTS (Areas A-1, A-3)					
No Action	No Action	Not Applicable	No Action	Retained. Used as baseline for comparison with other options as required by NCP. Low cost.	Common Approach
Limited Action	Institutional Controls	Deed Restrictions	Administrative action used to restrict future site activities on individual properties. Restrictions would prevent activities such as excavation or residential development.	Retained for protection of human health. Not protective of ecological receptors or groundwater. Low cost.	Common Approach
		Local Ordinances	Administrative action used to limit property use and activities such as well installation.	Retained for protection of human health. Not protective of ecological receptors or groundwater. Low cost.	Common Approach
	Access Restrictions	Fencing	Barrier erected to restrict access to contaminated properties.	Retained for protection of human health. Not protective of ecological receptors or groundwater. Low cost.	Common Approach
		Post Signs	Post "No Trespassing" or hazard warning signs.	Retained for protection of human health. Not protective of ecological receptors or groundwater. Low cost.	Common Approach
	Long-Term Monitoring	Groundwater Monitoring	Periodic monitoring events to determine whether soils, sediments, wetland soils, surface water, or groundwater are a continuing source of contamination.	Retained because there will be no removal of contaminants. Can be combined with other GRAs for continued assessment of existing site conditions. Moderate cost.	Common Approach



Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
 PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
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GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: FERRY CREEK SEDIMENTS (Areas A-1, A-3)					
Sediment Removal	Excavation	Bulk Mechanical Excavation	Use of common construction equipment to remove contaminated material.	Retained as potentially effective for protection of human health and protection of ecological species. Excessive handling and dewatering of saturated material and water handling and treatment will be required. Effective for all site contaminants. Moderate to high cost.	Common Approach
Sediment Removal		Dredging	Mechanical dredging equipment may be used to remove saturated material.	Retained as potentially effective for protection of human health and protection of ecological species. Dewatering of saturated material and water treatment will be required. Effective for all site contaminants. Moderate to high cost.	Well Established
Sediment Disposal	Disposal	Out-of-Town Landfill	Transport and disposal of untreated sediments to an approved out-of-town landfill.	Retained as potentially effective. Must be reviewed in concert with excavation/dredging technology. Material may require stabilization prior to transport and disposal. Moderate to high cost.	Common Approach

 Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
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GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: WETLAND SOILS (Areas A-1, A-3)					
		Solvent Extraction	Chemical desorption and dissolution of organic and some inorganic contaminants by washing soil with a solvent solution. Treatment will be done ex situ.	Eliminated. Not effective for wastes with multiple contaminant types. Not effective for asbestos. Solvent solution would need to be recovered and treated. Moderate cost.	Well Established
	Biological Treatment	Aerobic Biodegradation	Microorganisms degrade organic contaminants to carbon dioxide and water. Oxygen is used as an electron acceptor in the degradation process. Treatment may be done in situ or ex situ.	Eliminated. Effectiveness is limited to certain organic contaminants. Metals, PCBs, and asbestos are generally not amenable to biological treatment. Low cost.	Well Established
		Anaerobic Biodegradation	An electron acceptor other than oxygen is used in the process in which microorganisms degrade organic contaminants. Treatment may be done in situ or ex situ.	Eliminated. While this technology is commonly used in the wastewater treatment industry to effectively treat solid organic waste, applications in hazardous waste treatment are limited. Effectiveness is limited to certain organic contaminants. Metals, PCBs, & asbestos are generally not amenable to biological treatment. Low cost.	Not Well Established

 Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
 PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
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GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: FERRY CREEK SEDIMENTS (Areas A-1, A-3)					
		In-Town Landfill	Disposal of untreated sediments in a specially constructed landfill within the City of Stratford.	Retained as potentially effective. May not be feasible for entire volume of contaminated material as area is comprised of numerous small parcels. Must be reviewed in concert with excavation/dredging technology. Material may require stabilization prior to transport and disposal. Low cost.	Common Approach
Sediment Containment	Horizontal Barriers	Subaqueous Permeable Cap	Clean sediment and geosynthetics used to prevent direct contact with contaminated sediment.	Retained for protection of human health. May not be protective of ecological receptors. Low cost.	Common Approach
		Subaqueous Impermeable Cap	Clean sediment and geosynthetics are used to create an impermeable barrier between contaminated sediment and water in Ferry Creek.	Eliminated. Not feasible due to groundwater discharge to Ferry Creek. Also, tidal exchanges and flooding potential within Ferry Creek and the Housatonic River present difficult engineering issues to resolve. Moderate cost.	Well Established
Sediment Containment		Rip Rap	Rip rap and geotextile are placed over contaminated sediment in Ferry Creek to prevent direct contact and erosion and migration of contaminated sediment.	Retained for protection of human health. May not be protective of groundwater or ecological receptors. Low cost.	Common Approach
		Culvert	Construct concrete culvert to contain flow of Ferry Creek and prevent direct contact with creek sediments.	Retained for protection of human health. May not be protective of groundwater or ecological receptors. Moderate cost.	Common Approach


 Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
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GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: FERRY CREEK SEDIMENTS (Areas A-1, A-3)					
Sediment Treatment (Cont'd)		Thermal Desorption	Air, heat and mechanical agitation are used to volatilize organic contaminants from sediments into a vapor stream. Vapor is usually further treated. Treatment will be done ex situ.	Retained for potential use at an in-town location. Eliminated for use at and out-of-town location. Effective for organic contaminants (SVOCs, PCBs) but not effective for inorganic contaminants (metals, asbestos). May be used as part of a treatment train. Moderate cost.	Well Established
		Supercritical Water Oxidation	Contaminated sediments is exposed to water in a high temperature, high pressure environment. Under such conditions, organic substances are oxidized. Treatment will be done ex situ.	Eliminated. Effective for some organic contaminants (SVOCs) but not effective for inorganic contaminants (metals, asbestos) and PCBs. High cost.	Not Well Established
		Vitrification	Melting of contaminated material to volatilize or pyrolyze organics and entrain inorganics in a stable vitreous residual. Treatment will be done ex situ.	Retained. Potentially effective for all site contaminants. High cost.	Well Established

 Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
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GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: FERRY CREEK SEDIMENTS (Areas A-1, A-3)					
Sediment Treatment	Immobilization	Solidification/Stabilization	Equipment used to mix reagents with contaminated sediments to physically and/or chemically decrease the mobility of contaminants. Potential reagents include cement, pozzolanic material, thermoplastics, polymers and asphalt. Treatment may be done in situ or ex situ.	Retained as potentially effective. Demonstrated to be effective with metals and other inorganic (asbestos) and organic (SVOCs, PCBs) contaminants. Moderate cost.	Well Established
		Microencapsulation	Contaminated material is encapsulated by containers or inert and impervious coatings that will minimize leaching. Treatment will be done ex situ.	Eliminated. Effectively isolates all site contaminants but no treatment occurs. Not feasible in cases involving large quantities of contaminated material. High cost.	Not Well Established
	Thermal Treatment	Incineration	Destruction of organic contaminants by subjecting them to high temperatures under controlled conditions in a combustion chamber. Treatment will be done ex situ.	Eliminated. Effective for organic contaminants (SVOCs, PCBs) but not effective for inorganic contaminants (metals, asbestos). Not easily undertaken within the town of Stratford, on or off site. High cost.	Well Established
		Pyrolysis	Chemical decomposition of organic contaminants by heating the material in the absence of oxygen. Treatment will be done ex situ.	Eliminated. Effective for organic contaminants (SVOCs, PCBs) but not effective for inorganic contaminants (metals, asbestos). Not easily undertaken within the town of Stratford, on or off site. High cost.	Not Well Established


 Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
 PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
 DRAFT TECHNICAL MEMORANDUM
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GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: FERRY CREEK SEDIMENTS (Areas A-1, A-3)					
Sediment Treatment (cont'd)	Physical Treatment	Soil Flushing	Contaminants sorbed to sediments are mobilized or dissolved in an aqueous flushing solution in situ. The flushing solution is then extracted from the subsurface and treated. Flushing solution may be augmented by chemicals which increase the mobilization or dissolution of organics and some heavy metals from the sediments. Treatment will be done in situ.	Eliminated. Not effective for saturated sediments. Not a reliable method in cases involving multiple types of contaminants. Moderate cost.	Well Established
		Soil Washing	Process reduces the amount of contaminated material by two means. Finer particles, which contain the bulk of contaminants, are separated from more coarse material. Contaminants sorbed to sediments are dissolved in an aqueous washing solution. The wash water may be augmented by chemicals which increase the leaching of organics and some heavy metals from the sediments. Treatment will be done ex situ.	Retained. Potentially effective for organics (SVOCs, PCBs) and some inorganics (metals, asbestos), but multiple washing steps may be necessary. Washing solution would need to be recovered and treated. Not a reliable method in cases involving multiple types of contaminants. May be used as part of a "treatment train". Can be done on or off site within Stratford. Moderate to high cost.	Well Established


 Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
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GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: FERRY CREEK SEDIMENTS (Areas A-1, A-3)					
		Liquefied Gas Solvent Extraction	Liquefied gas solvents, such as propane, are used to extract organics from sediments. Treatment will be done in situ.	Eliminated. Technology is not commercially available and effectiveness is not well established. Not effective for saturated sediments. Cost information not available.	Not Well established
		Soil Vapor Extraction	In situ technology in which vacuum blowers and extraction wells are used to strip volatile organic compounds from unsaturated sediments. Treatment will be done in situ.	Eliminated. Only effective for volatile organic compounds (VOCs) in non-saturated soils. Not effective for SVOCs, metals, PCBs, asbestos. Moderate cost.	Well Established
		Electrokinetics	Electrodes are used to manipulate sediments conditions to recover or destroy organics and metals. Treatment will be done in situ.	Eliminated. Potentially effective for organic (SVOCs, PCBs) and some inorganics (metals) but not effective for asbestos. Not effective for saturated sediments. Cost info not available.	Not Well Established
Sediment Treatment (cont'd)	Chemical Treatment	Chemical Dechlorination	Chlorine atoms are stripped from chlorinated contaminants through chemical reactions to produce less toxic byproducts. These byproducts are generally more amenable to biodegradation. Treatment will be done ex situ.	Eliminated. Only addresses chlorinated compounds (PCBs). PCBs are very stable - may be resistant to dechlorination. Not effective for non-chlorinated organics (SVOCs) or inorganics (metals, asbestos). Cost information not available.	Not Well Established


 Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
 PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
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GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: FERRY CREEK SEDIMENTS (Areas A-1, A-3)					
		Phytoremedia- tion	Plants are used to naturally remediate contaminants via three mechanisms: direct uptake and accumulation of contaminants in plant tissue, release of enzymes that stimulate microbial activity and biochemical transformation, and enhancement of mineralization in plants' roots. Effective for destruction of some VOCs and SVOCs and effective for absorbing many inorganics. Not demonstrated as effective for PCBs. Treatment will be done in situ.	Eliminated . Potentially effective for metals, SVOCs; not effective for asbestos, PCBs. Root systems of plants may not extend deep enough to remediate contaminants at depth. Plants would require harvesting, proper disposal, and replanting. Reliable cost information not available.	Not Well Established

 Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
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GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: FERRY CREEK SEDIMENTS (Areas A-1, A-3)					
		Chemical Oxidation	Oxidants are injected into the subsurface where they react with contaminants to form harmless end products. Can be used to remediate a wide range of organic contaminants. Treatment will be done in situ.	Eliminated. Does not address inorganic contaminants (metals, asbestos). PCBs may be difficult to oxidize. Not effective for saturated sediments. Moderate cost.	Well Established
		Solvent Extraction	Chemical desorption and dissolution of organic and some inorganic contaminants by washing sediments with a solvent solution. Treatment will be done ex situ.	Eliminated. Not effective for wastes with multiple contaminant types. Not effective for asbestos. Solvent solution would need to be recovered and treated. Moderate cost.	Well Established
	Biological Treatment	Aerobic Biodegradation	Microorganisms degrade organic contaminants to carbon dioxide and water. Oxygen is used as an electron acceptor in the degradation process. Treatment may be done in situ or ex situ.	Eliminated. Effectiveness is limited to certain organic contaminants. Metals, PCBs, and asbestos are generally not amenable to biological treatment. Low cost.	Well Established
Sediment Treatment (cont'd)		Anaerobic Biodegradation	An electron acceptor other than oxygen is used in the process in which microorganisms degrade organic contaminants. Treatment may be done in situ or ex situ.	Eliminated. While this technology is commonly used in the wastewater treatment industry to effectively treat solid organic waste, applications in hazardous waste treatment are limited. Effectiveness is limited to certain organic contaminants. Metals, PCBs, & asbestos are generally not amenable to biological treatment. Low cost.	Not Well Established


 Eliminated process option (see screening comment)

TABLE 2-7 (cont.)
 PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
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GENERAL RESPONSE ACTIONS (GRA)	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	DESCRIPTION OF REMEDIAL TECHNOLOGY TYPES	SCREENING COMMENT ¹	STATUS ²
ENVIRONMENTAL MEDIUM: SOILS (Areas A-1, A-2, A-3)					
Consolidation	Consolidation	Consolidation	Transport and consolidation of contaminated material at an in-town location.	Retained. Must be reviewed in concert with excavation technology. . Material may require stabilization prior to transport and disposal. Low cost.	Well Established
Other					

Note:

"On-site" refers to within the study area. "Off-site" refers to outside the study area.

1. See Section 2.4 for a further discussion of technologies which were retained or were eliminated for reasons other than "not well established".
2. Status terms are defined as:

Common Approach: Method which is commonly used and widely accepted in the environmental engineering field.

Well Established: Method proven to be feasible on a full-scale basis, but may not be commonly used in the environmental engineering field.

Not Well Established: Use of method to date is generally confined to field trials or bench scale studies.


 Eliminated process option (see screening comment)

TABLE 2-8
APPROXIMATE COST OF APPLICABLE REMEDIAL TECHNOLOGIES
DRAFT TECHNICAL MEMORANDUM
REMEDIAL ALTERNATIVES SCREENING
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GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	APPROXIMATE COST (\$ per CY)			Approximate Additional Costs per CY ^a (\$)
			Soils	Wetland Soils	Sediments	
No Action	No Action	Not Applicable	0	0	0	0 to 0
Limited Action	Institutional Controls	Deed Restrictions	0	0	0	0 to 0
		Local Ordinances	0	0	0	0 to 0
	Access Restrictions	Fencing	0	0	0	0 to 0
		Post Signs	0	0	0	0 to 0
	Long Term Monitoring	Monitoring	0	0	0	0 to 0
Removal	Excavation	Mechanical Excavation ^{*1}	9.5	11.5	14	3 to 7
	Dredging (includes dewatering)	Mechanical dredging ¹	NA	75	75	19 to 38
		Hydraulic dredging ¹	NA	220	220	55 to 110
		Pneumatic dredging ²	NA	220	220	55 to 110
Disposal	Disposal	Out-of-Town ³	170	170	170	43 to 85
		In-Town Landfill (\$7.81/SF) ^{1,3}	18	18	18	5 to 9
Removal and/or Treatment	Immobilization	Solidification/Stabilization ⁵	50-80	50-80	50-80	13 to 40
	Thermal Treatment	Vitrification ⁵	300-500	300-500	300-500	75 to 250
		Thermal Desorption ⁵	60-100	60-100	60-100	15 to 50
	Physical Treatment	Soil Washing ³	130	130	130	33 to 65
Containment	Horizontal Barriers	Impermeable Cap (\$3.05/SF) ¹	15-26	21	NA	4 to 13
		Permeable Cover (\$0.63/SF) ¹	3-5.5	4.5	4.5	1 to 3
		Rip Rap (\$2.83/SF) ¹	NA	19	19	5 to 10
		Culvert (\$3,500/LF) ⁶	NA	NA	900-950	225 to 475
Consolidation	Consolidation	Consolidation ⁴	3.5	3.5	3.5	1 to 2
Other						
Other						
Other						

* includes backfilling

Source of Estimate:

1. From ECHOS Heavy Construction Cost Data Book, published by RS Means Co. 1998.
2. Assumed to be the same as Hydraulic Dredging
3. From ECHOS Environmental Remediation Unit Cost Book, published by RS Means Co. 1998.
4. Assumption based on previous site experience. 3.5 miles @ \$20/mile, 20 CY load. Only includes transportation to in-town location.
5. Quote submitted by vendor.
6. Preliminary estimate submitted by Army Corps of Engineers.
7. US EPA. 1994. "ARCS Remediation Guidance Document." EPA-905-B94-003. Great Lakes National Program Office, Chicago, IL.
8. Additional Costs includes expenses for mobilization/demobilization, sampling & analysis, site preparation and restoration, decontamination facilities, well replacement/installation, and other site work needed to support the selected process option(s).
Based on detailed cost estimates present in the OU-1 Feasibility Study (1995), Additional Costs were assumed to be 25 to 50% of process option unit costs.